USING CROSS-SECTIONAL BIOMONITORING STUDIES TO EXPLORE THE RELATIONSHIP BETWEEN HUMAN BODY BURDEN AND AGE

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Background and Aims: Cross-sectional data sets are a compilation of different individuals whereas the longitudinal body burden trends are for only one individual over their entire lifetime. Numerous studies have reported cross-sectional biomonitoring data of polychlorinated biphenyls (PCBs) with human body burdens increasing continuously into old age. This relationship has been previously interpreted to indicate the role of age on bioaccumulation. We propose that what has been interpreted as an increase in body burden with age is actually a result of the temporal relationship between the sampling period and the peak in emissions. The purpose of this research was to investigate which factors control the concentration versus age relationship.
Methods: Population cross-sections were generated from longitudinal calculations using the mechanistic model CoZMoMAN that links emissions to the environment with human body burdens. Body burden-age trends were generated from the longitudinal body burden calculations for human exposure to hypothetical chemicals with various partitioning and degradation properties. The influence of model assumptions and emissions peakedness are also examined.
Results: The temporal relationship between the emissions scenario time trend and the biomonitoring sample collection period is the most influential factor controlling the shape of concentration-age trends for population cross-sections. For chemicals with degradation half-lives of 1 year or less, the relative concentration-age trend is always the same. Published biomonitoring studies for PCBs and PBDEs are interpreted in the context of the relationship between emissions and metabolic degradation.
Conclusions: Bioaccumulation does not monotonically increase with age. The main predictors of cross-sectional body burden trends with age are the amount of time elapsed after emissions peaked and the chemical degradation rate.